

Baltimore Metropolitan Council



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August 2, 2005

Mr. Michael Culp
Transportation Model Improvement Program
Federal Highway Administration
Washington, D.C.

Dear Mr. Culp:

On behalf of the Baltimore Regional Transportation Board (BRTB) and the Baltimore Metropolitan Council, I would like to thank the Federal Highway and Federal Transit Administrations for their contribution to the completion of a Peer Review of the Baltimore Regional Travel Demand Model. The Peer Review Panel, assisted by the professional staff of the Volpe Center, was extremely qualified and prepared for the task at hand and provided thoughtful and insightful recommendations for the Baltimore Metropolitan Planning Organization (MPO) to entertain in future technical modeling applications.

While the Peer Review Panel findings, as outlined in the document titled "Report on Findings of the Second Peer Review Panel of the Baltimore Metropolitan Council Travel Demand Model" dated July 2005, seem to capture the intricate regional travel forecasting process as applied in the Baltimore metropolitan area by the Baltimore MPO, the attached comments to the five major recommendations noted in the Executive Summary of the said report are offered as a "next steps" approach to be implemented in the coming years as resources are available and state-of-the-practice warrants application.

In keeping with the informative and public education intent of the metropolitan planning process, please post this response on the U.S. Department of Transportation Travel Model Improvement Program website. All follow-up questions regarding the Peer Review Panel process should be directed to Mr. Gene Bandy, Manager of Technical Services, Baltimore Metropolitan Council. Mr. Bandy can be reached at 410-732-9573.

Again, thank you in advance for your cooperation in this matter.

Sincerely,

Harvey S. Bloom, Director
Transportation Planning

Attachments

Baltimore Metropolitan Planning Organization's Response to Peer Review Panel Findings of the Baltimore Metropolitan Travel Demand Model

- 1. Make revisions to the traffic analysis zones early in the model improvement process, since this will affect later stages of the process.**

We agree that splitting transportation analysis zones (TAZ) will provide better information on travel behavior in the Baltimore region. With this in mind, BMC staff, in concert with the MPO's Technical Committee and Cooperative Forecasting Group, will begin to develop the work tasks associated with this activity for the purpose of including this task in a future Unified Planning Work Program. Local jurisdiction assistance is essential to this activity, thus local governments must allocate time to determine an updated zone structure in coordination with new census geography to be proposed in 2008.

- 2. Continue to coordinate closely with the Metropolitan Washington Council of Governments on employment and population forecasts, since the contiguous planning regions of Baltimore and Washington, DC function as a single metropolitan area.**

The BMC attempts to account for the strong employment growth in the Washington region by including Frederick County, Prince George's County, Montgomery County and the District of Columbia (all in the MWCOG planning area) in its travel demand modeling area. By doing so, Baltimore's model can incorporate not only its own socio-economic forecasts but also Washington regional forecasts in its modeling activity. The BMC also considers employment forecasts for all jurisdictions in Maryland by reviewing the statewide employment forecasts created by the Maryland Department of Planning, which is also a member of the BRTB's and MWCOG's Cooperative Forecasting Group. Both BMC and MWCOG purchase and evaluate employment forecasts for their jurisdictions and surrounding states in the Baltimore-Washington area by Woods and Poole Economics, Inc.

The BMC and MWCOG staffs have increased their interaction in the development of forecasts for each area by engaging in bi-monthly staff-to-staff meetings on this issue. Also, representatives from each MPO continue to attend the other's Cooperative Forecasting Group (CFG) meetings. The BRTB CFG sponsored an employment forecasting workshop for Baltimore area jurisdictions with participation by MWCOG staff specifically to address forecasting methodology and to evaluate jobs/labor force scenarios in the region.

- 3. Ensure that any changes, especially in the mode choice model, are compliant with New Start guidelines produced by the Federal Transit Administration.**

Over the past 18 months, BMC and the Maryland Transit Administration (MTA) have been working together to develop and implement a methodology to study the Red Line Transit Corridor in the Baltimore region. After much discussion and consultation with various transportation professionals, it was decided that a “starting from scratch” approach that resulted in a complete restructuring of the Baltimore regional travel demand model as compared to a fix of the model’s mode choice element was in order. Given the competitive nature of federal revenue assistance in support of New Start infrastructure investments, BMC and MTA met with FTA officials in April 2005 to review the region’s recommended approach to ensure consistency with federal New Starts guidelines. As expected, FTA offered numerous suggestions and agreed to follow-up discussions once the restructured model has been validated (see Attachment No. 1). In the interim, BMC has prepared a FY 2006 work program (see Attachment No. 2) to continue its efforts in planning for a new transit corridor in the Baltimore region.

4. Consider adding demographic factors such as the age of the head of the household or number of workers in the household to add explanatory power to the regional travel model.

As part of the overall model update, BMC staff are presently revising household demographic variables used in trip generation. Two joint distributions have been developed using models calibrated to 2000 census data. The first model estimates the number of TAZ households by size (5) and income (4) and the second model estimates the number of TAZ households by workers (4) and income (4). The households by size model will be used in the production of non-work trips and the households by workers will be used in the production of work trips. Both models use a distribution of household income divided into four groups (10%, 15%, 20%, and 55%). The income groups were defined to capture difference in trip generation, length, and model preference. These market segmentation approaches have been vetted with regional transportation planners and professionals.

5. Be sure that modeled speeds are reasonable compared to actual speeds.

We are in complete agreement with this recommendation. Since 1998, BMC has been collecting peak (A.M. & P.M.) and off-peak vehicle speed data in corridors of various roadway types throughout the Baltimore metropolitan area. Drivers were assigned specific roadway networks and, equipped with a Global Positioning System unit, collected travel time and travel speed data in a manner that allowed for a proper sample. It is the intent of BMC staff to compare this historical dataset with modeled speeds and, where appropriate and reasonable, employ real world speeds in the regional travel model. To date, data comparisons have begun.



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MEMORANDUM

TO: Gene Bandy
FROM: Matthew M. de Rouville *MMR*
DATE: May 18, 2005
SUBJECT: April 21 Meeting with Federal Transit Administration (FTA) on Maryland Transit Administration (MTA) Red Line Study

A meeting was held on Thursday, April 21, 2005 at the Federal Transit Administration (FTA) headquarters in Washington to discuss the technical issues relating to the Red Line Transit study. The following were in attendance:

Jim Ryan, FTA

Dwayne Weeks, FTA

Eric Pihl, FTA,

Ernie Baisden, MTA

Lorenzo Bryant, MTA

Bill Allen, Consultant

Gene Bandy, Baltimore Metropolitan Council (BMC)

Charles Baber, BMC

Matt de Rouville, BMC.

Action items are indicated in **boldface type**. Following this summary is an attached list of work activities to address these concerns.

After introductions, Bill Allen gave the background of the project. He referred to the proposed work plan he submitted to MTA. We are "starting from scratch" to redo the entire model chain, not just the mode choice portion. Key issues include:

- Project AA/DEIS schedule

- Passing muster with FTA
- Incorporate income stratification from the beginning in person trip table
- Adopt New Orleans model with Columbus coefficients and nested structure for mode choice
- Transit assignment with line and station volumes

The year 2000 would be the base year for the model. This is a census year, and supporting data would come from the 2001 National Household Travel Survey, transit on-board surveys from 1996 and 2004 (the latter bus-only from the MTA Comprehensive Bus Study), and 2003 ride check (boarding/alighting) data.

Jim Ryan stressed the importance of using survey data to validate the base model (transfers, speeds, etc.) and was concerned about the lack of more recent survey data for all transit modes. Since the 1996 data covered all transit modes, this would be the best data to calibrate from. The 2004 bus-only survey may not be the best for developing the model, but we could make use of these data. Bill Allen noted that Gallop Corporation was developing a 2000 transit trip table, and that **BMC staff will take a look at it to determine if it includes rail.**

Jim Ryan went on to say that the New Orleans model had become the national default model. No peer review panel could find fault with it.

One of the factors used in the present BMC mode choice model was highway distance for commuter rail access (since commuter rail tends to attract longer trips). Jim said he had no trouble with that.

Bill discussed his intention to use composite time, which did not raise any objections. Concerning the Census data, Bill noted that Part II had many problems with geocoding, although Jim responded that the same errors could be found in Part III. **BMC staff will look at this.**

Another issue was to examine actual and simulated bus speeds. **BMC staff will document these findings.** Dwayne noted that different transit speeds in base and alternative scenarios will be closely examined.

Jim stated that it is important for the model to look at the "big picture." The model should show insights to problems, look at alternatives, take a snapshot of today and the future, look at growth and trade-offs and look at the merit of "chosen" projects. Your product should tell a story. He mentioned that **documentation on "how we model the region" would be good to do.** The mode choice model must accurately reflect market shares and travel time.

Bill noted his plans for trip generation:

- Households by income and workers for work purposes
- Households by income and size for non-work purposes
- Currently, there are four area types, but we may want to have more or use a continuous function
- Income stratification will be used for all home-based purposes. Four categories will be used which take in 10, 15, 20, and 55% of the population (from lowest to highest).

For trip generation, Jim would like to see us **plot the data and then smooth the curve in the production rates** rather than simply combining cells.

Jim noted that it would be risky to shorten the schedule just to meet a deadline. It would be more important to **do things right and focus on quality control.**

Jim noted that there should be rules for transit network coding and assignment. BMC staff need to check paths, frequency distribution, number of transfers, and speed estimates for extensions. There should be documentation of paths by path type. Factoring in highway speeds to get transit times may overstate transit times in the future as highway congestion increases. **A better way is to use stop delay.**

In developing targets for model calibration, aggregate targets are necessary but not sufficient. **We should have district-to-district tabulations.** We need to define what the transit system does and if the model knows what it does. Alternate-specific constants should be monotonic, i.e., move logically in the same direction.

For trip distribution, Bill proposed **using a composite time.** He had a question about the weights to use for transit. Originally, we were going to use transit share, but that did not work well in Charlotte. Tom Walker of the Delaware Valley Regional Planning Commission had a good method to do this.

For mode choice, we need to look at peak and off-peak trip making, especially accounting for work trips in the off-peak. Time of day analysis is important (as defined in Bill's work plan). Bill wants the distribution model to be "transit-aware."

On trip assignment, the issue of the equilibrium model came up. There is often difficulty in comparing alternatives because complete closure is not reached. Jim informed us that there was a problem in the TP+ algorithm. Matt noted that we were considering using fixed weights for all scenarios based on a future-year assignment Jim stated that would be a "partial solution." He went on to say that 1000 iterations might be worth it for a billion dollar project, but wasn't sure if significant reiterations produce measurable differences. Any strange immeasurable result remote from the corridor could be interpreted as "noise" in the model. **We may want to look into doing 50 iterations and ask Wade White of Citilabs about the problem with TP+.**

Jim noted that a forecasting step in the work program is an excellent idea. **A new rail line should be included in this analysis.**

Jim was asked about a connection between TP+ and SUMMIT. SUMMIT can now read native formats of major modeling software packages. Just a few final steps are needed for complete compatibility. **FTA was working on that.**

Bill asked about the requirement for the same person trip table to be used across different scenarios: which one should be used? **Jim noted that the baseline trip table should be used.**

When asked whether transit should be constrained by parking availability, Jim noted that it was "highly meritorious." **Bill suggested using some form of "shadow pricing" to do this.** Land-use assumptions at stations should be commitments from the cooperative forecasting process.

Jim agreed to a horizon year of 2030.

He suggested assigning the on-board transit survey trip table. Also, assign the drive access trips only and document results.

As far as coding BRT as a bus, **maybe use a bias coefficient.** This must be carefully thought out. For the constant, anything greater than a 12 minute equivalence to in-vehicle time is not acceptable to Jim. Jim noted that we could look at the Dallas model.

Jim stated that there should be three steps in the model validation:

- Volumes match counts
- Constants make sense; does the model tell a coherent, valid story of how trips behave?
- Perturbations in the forecasts – deltas are valid and make sense

In developing transit access, separate distances should not be used for walk and drive modes. Walk to bus and rail modes should be the same. Don't make them real long. Bill stated he likes the methodology used in Atlanta. **We should consider extending the sidewalk network to all roads except freeways. More path tracing should be done when checking coding to see how well the model works and how people really use the system. We could assign the Metro riders only and check their paths.**

Next steps include completing production, attraction, and external models over the next several weeks. **BMC will have to have transit networks ready by then with good documentation. Our next meeting should be in early July, and we should**

have a validation of the network ready by then. Dwayne will schedule the meeting. Eric stressed the importance of quality control testing.

cc: Harvey S. Bloom
Charles Baber
Paul Gilliam
Vimal Kumar
Brian Ryder
William G. Allen
Ernest Baisden
Lorenzo Bryant
Eric Ho, Gallop Corporation
Dudley Whitney, Parson Brinkerhoff

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Meeting With FTA on Red Line Model Methodologies

List of Work Activities/Concerns

Action	Comments
1. Research & use existing data <ul style="list-style-type: none"> - 1996 Transit On-Board Survey - 2000 Census Data (Part II & III) - 2001 NHTS - 2004 Comprehensive Bus Survey - Ride Checks - Gallop Corporation 2000 Transit Trip Table - Develop target trip tables—district to district by access mode 	Make best use of data <ul style="list-style-type: none"> - Geocode, display and assign transit trips; document - Display/graphics - Display/graphics - Obtain & analyze - Obtain & analyze - Obtain & analyze
2. Validate & explain base network <ul style="list-style-type: none"> - Check highway speeds/times - Check transit speeds/times - Check highway & transit paths - Produce report “Here Is How We Model the Region” - Walk sheds for bus and rail should be the same and not too long - Is delay because of traffic congestion <u>or</u> number of transit stops? - Check bus stop locations (geocode) - Assign 1996 on-board transit trips; assign Metro riders - Assign drive access trips only - Are the <u>deltas (difference between observed and modeled)</u> valid and do they make sense? - Walk links on all arterials (even outside of CBD) 	Tell story (look at Big Picture) <ul style="list-style-type: none"> - Use GPS data; point-to-point info - Use schedules, etc. - Document - Include: rules for network coding; validation tables; assigning reasonable volumes; reasonable paths, transfers, penalties, speed estimation - Maybe use an explicit method to measure stop delay - MTA file? - Check purpose, access modes, number of transfers, paths, and document - Check results/document - FTA suggested!
3. Trip Generation <ul style="list-style-type: none"> - Incorporate income stratification from the beginning - Plot the production rates and smooth them - Analyze households & income - Analyze workers by income 	<ul style="list-style-type: none"> - Stratification shares of 10%, 15%, 20%, and 55% acceptable - “Curve” rates may be better. Just plot points and move them accordingly - 2 separate stratifications - Continuous function looks good; eliminate cliffs
4. Trip Attractions <ul style="list-style-type: none"> - Stratify by income 	<ul style="list-style-type: none"> - Not easy; 30 gravity models 10, 15, 20, 55

5. Trip Distribution <ul style="list-style-type: none"> - Look at District to District tabulations - Review person trips to and from Washington region <ul style="list-style-type: none"> o Commuter rail/trip length - Composite time - Tom Walker (DVRPC) Approach 	<ul style="list-style-type: none"> - Highway distribution utility function acceptable for MARC - FTA: OK - Investigate
6. Mode Choice <ul style="list-style-type: none"> - Alternative-specific constants should show monotonicity - Look into work trips – Peak vs. off-peak relationships - Time of day analysis - Use the New Orleans Model (nesting structure) - Constraints of allowable parking at stations 	<ul style="list-style-type: none"> - Logical looking bias coefficients - Is necessary - Work trips in the off-peak - The National Default Model - Model may need a manual tweak or shadow pricing charge
7. Assignment <ul style="list-style-type: none"> - Problem with TP+ Algorithm - Use of weighted iterations is a "partial solution" 	<ul style="list-style-type: none"> - Contact Wade White in assignment - At least 50 iterations may be necessary for some convergence – maybe 1000 for a billion dollar project
8. Analysis <ul style="list-style-type: none"> - Prepare User Benefits (base vs. build) - Speed assumptions for alternative modes must be realistic - Forecasting step with new rail line should be done in model testing - Figure out trade offs of nested structure - You may need to use bias coefficients (BRT vs. Bus (on same street)) - Use a fixed person trip table. - Bill said: 2 sets of numbers are confusing (one with common trip table, one where model is run all the way through for each scenario) 	<ul style="list-style-type: none"> - Differences in coefficients allowing greater than the equivalent of 12 minutes of in-vehicle time are not acceptable - Use the Base (TDM) case - FTA finds two sets of numbers acceptable